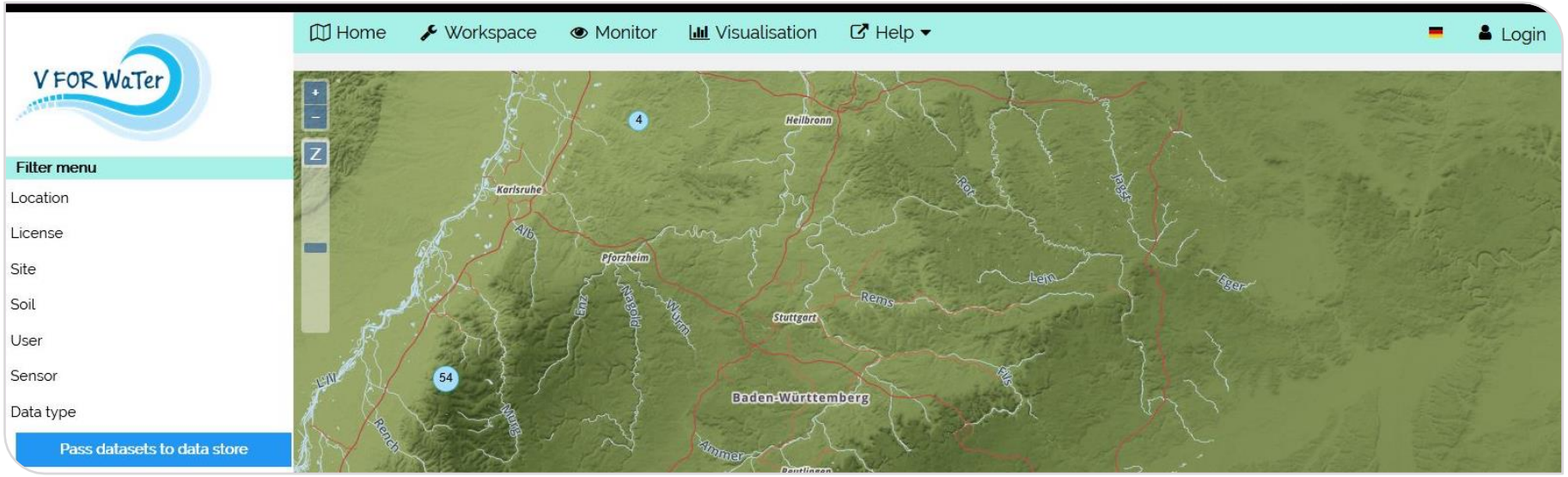
Karlsruhe Institute of Technology

V FOR WaTer

V-FOR-WaTer –

a virtual research environment for environmental research



Who are we?

Karlsruhe Institute of Technology

Hydrology (IWG)

Computer science (SCC)


Sibylle Haßler


Mirko Mälicke


Erwin Zehe


Jörg Meyer


Marcus Strobl


Elnaz Azmi

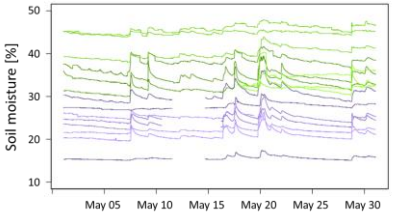
Close collaboration and communication (“common language”)

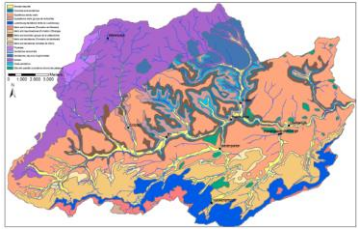
- Project originally funded by the Ministry for Education and Research in Baden-Württemberg
- Follow-up projects: Digital Earth („BRIDGET“), ExU KIT („SmaRD-AI“), DFG LIS („ISABEL“, TBD), …

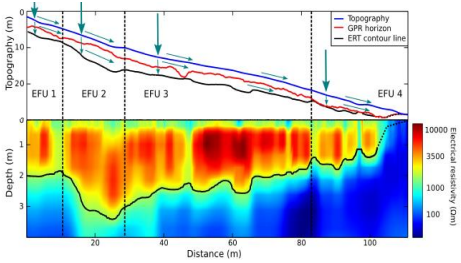
Inspiration – experience within CAOS project

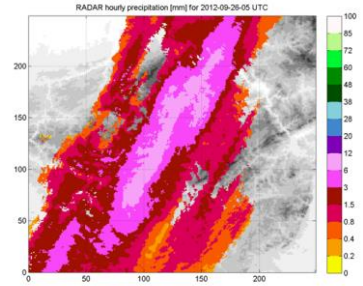
Diverse project data:

- Sensor time series
- Maps of geology, soils, landuse, digital elevation model
- Macropore and earthworm distributions
- Geophysical images
- 4D precipitation radar information
- Short-term surveys, lab data and experiments
- Model configurations and results









Inspiration – experience within CAOS project

Challenge:

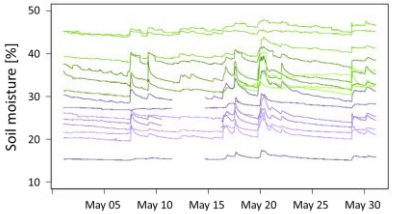
- Share the project data among partners
- Include all necessary metadata to understand and work with the data
- Which infrastructure to use?

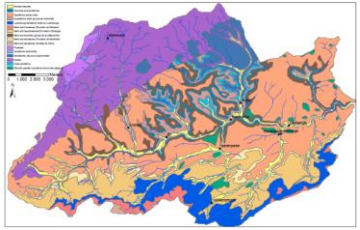
Approach:

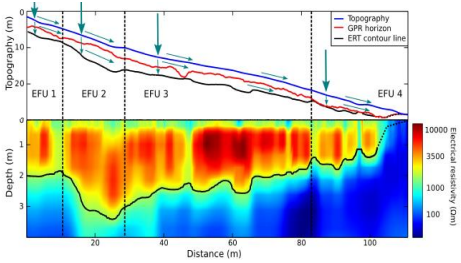
- CUAHSI for time series
- Folder structure for 2D data

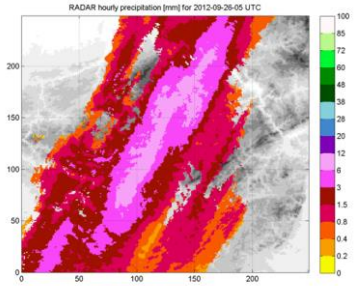
→ CUAHSI not used in the end

→ potential of project data not reached









Goals for V-FOR-WaTer

- Quick and simple access to hydrological data
- Quick pre-processing of data from diverse data sources
- Shared tools and workspace for reproducible data analysis
- Include uncertainty information of data

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- Centralize hydrological data from universities and state offices for a coordinated long-term monitoring
- Security layer to ensure that users can access only data for which they have access rights

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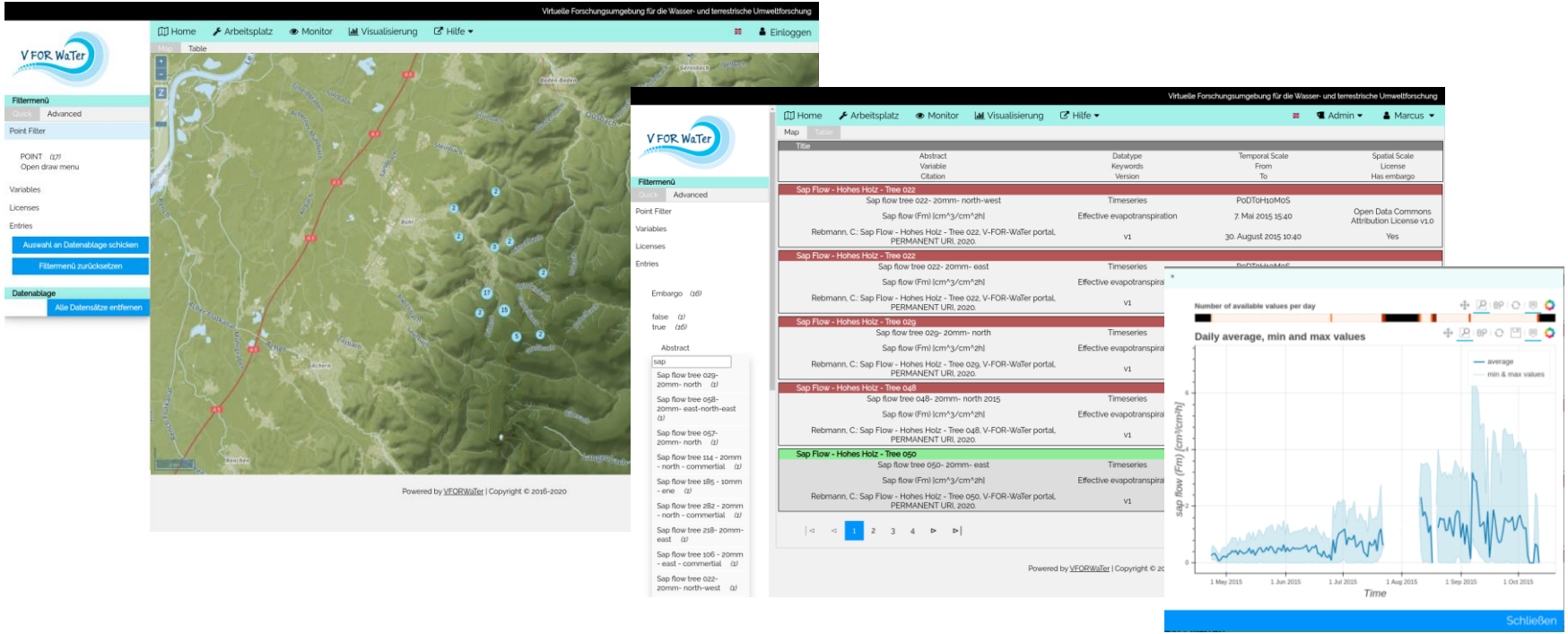
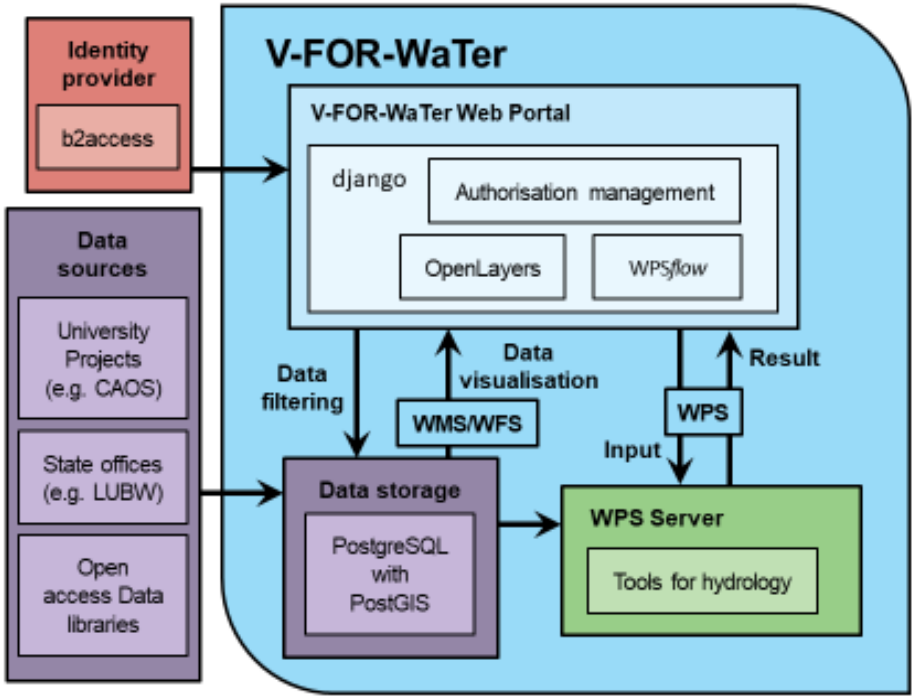
Offer a specialized solution for hydrologists and environmental scientists but ensure compatibility with overarching initiatives.

What does it look like?

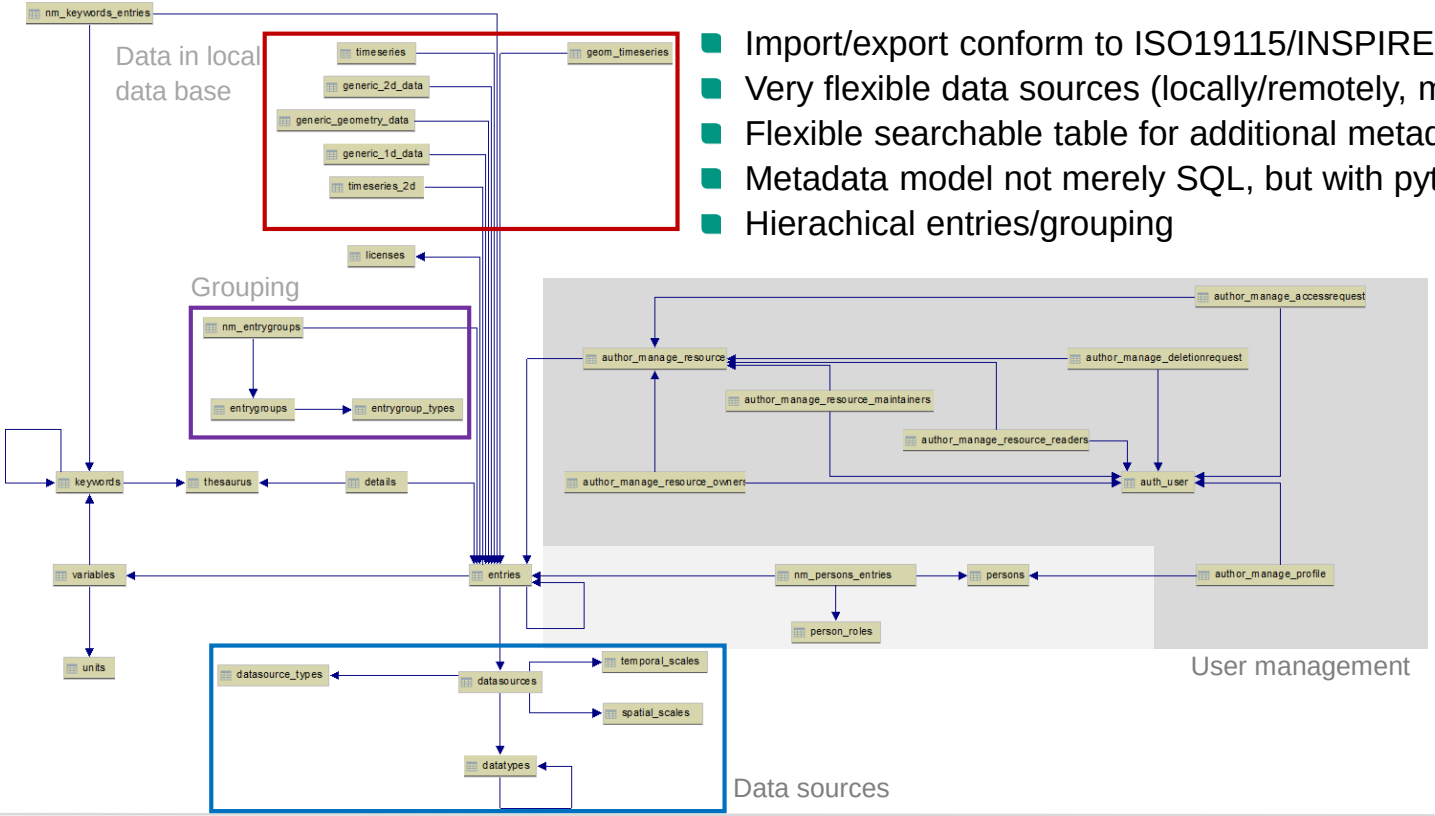


Technical implementation



- Authentication
- Fine-grained user management
- Database with spatial reference
- Adaptable metadata scheme
- WPS server for tools
- Web Portal
  - Filters/previews
  - Tools/workspace
  - Import/export

Metadata scheme

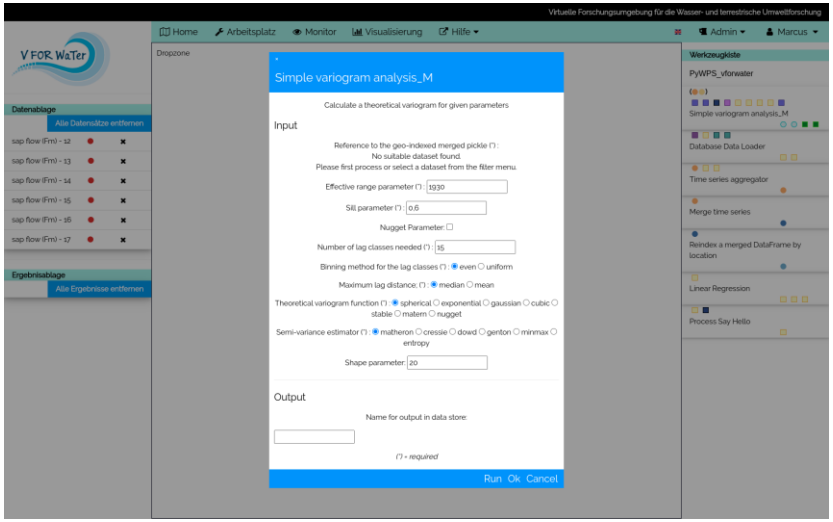


- Import/export conform to ISO19115/INSPIRE
- Very flexible data sources (locally/remotely, most formats, 2D/3D)
- Flexible searchable table for additional metadata
- Metadata model not merely SQL, but with python mapping and API
- Hierachical entries/grouping

Tools in V-FOR-WaTer

- Tools
  - Map tools
  - Simple pre-processing / statistical tools
  - Visualisation
  - Tools for special hydrological analyses
  - Geostatistics
  - Specialised evapotranspiration toolbox (BRIDGET)
  - User-developed tools

- Workflow manager
  - Combine individual tools into workflow
  - Saveable, reproducible

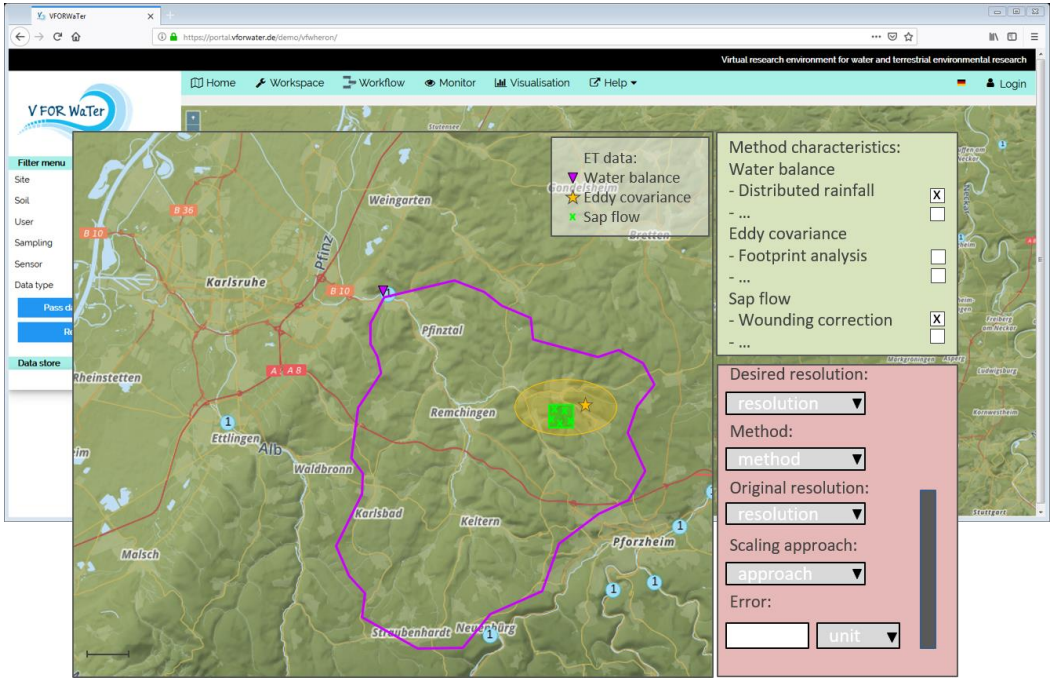


Geostatistics tool – variogram analysis

Evapotranspiration toolbox (BRIDGET)

Collaboration with Corinna Rebmann (UFZ), Matthias Mauder/Ralf Kiese (KIT Garmisch)

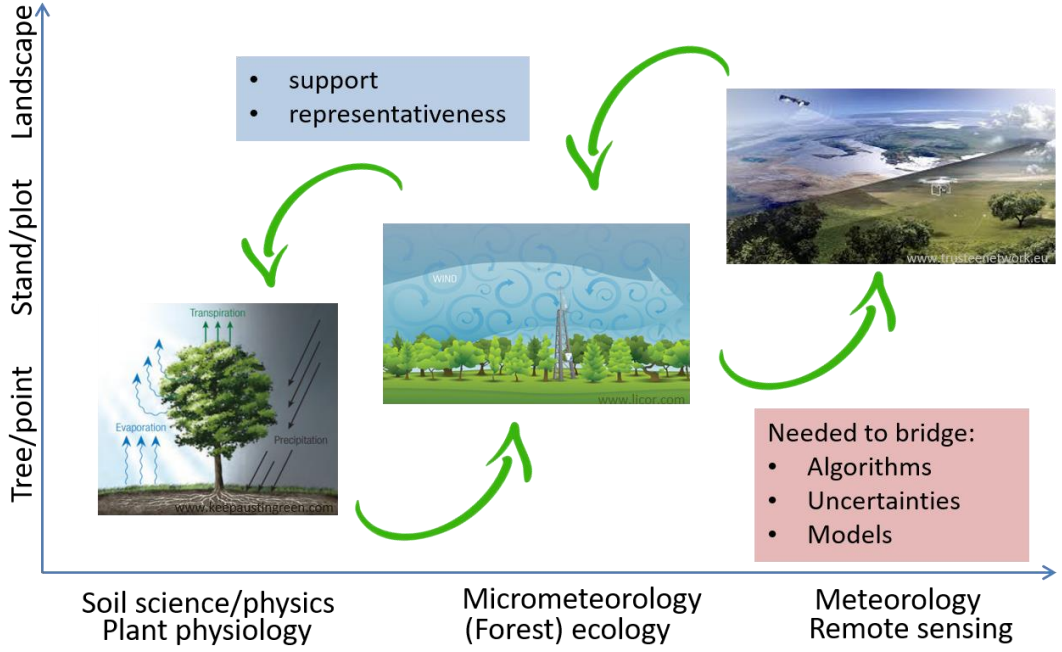
- Particular emphasis on dealing with method-specific uncertainties
- Example for including a user-developed tool into V-FOR-WaTer
- Integrate various ET flux measurements across methods, disciplines and scales



Evapotranspiration toolbox (BRIDGET)

Collaboration with Corinna Rebmann (UFZ), Matthias Mauder/Ralf Kiese (KIT Garmisch)

- Demand:
  - Include ET information at different scales
  - Integration and comparison between methods/models
  - Bridging scales
  - Assess uncertainty propagation during scaling steps
- Challenge:
  - Methods discipline-specific
  - Appropriate description of metadata
  - Include method-specific pre-processing tools
  - Uncertainty estimation and display



Special features of V-FOR-WaTer

- Standardisation
  - Metadata:
    - Formats: ISO 19115, INSPIRE, export also to DataCite and DublinCore
    - Controlled vocabularies: NASA Global Change Master Directory (GCMD) keywords for Earth Science
  - WPS (OGC Web Processing Service): input and output of tools, supported by several programming languages
  - Tools as independent python packages
- Include data from LUBW
  - Discharge data – key data for many hydrological questions
  - Advantage for LUBW: data is being used for analyses, distribution of bulk data, access to higher-resolution data for model validation
  - Vision: also connect to DWD and other relevant data sources
- Connection to repository
  - GFZ Data Services, possibly KITopen in the future

Open source

- vforwater-portal: portal of the virtual research environment
  https://github.com/VForWaTer/vforwater-portal
- pleasant: django-based skeleton of a web portal application with maps
  https://github.com/VForWaTer/pleasant
- hydrobox: hydrological preprocessing and analysis toolbox
  https://github.com/mmaelicke/hydrobox
- scikit-gstat: geostatistics tools
  https://github.com/mmaelicke/scikit-gstat
- metacatalog: database scheme and management package
  https://github.com/VForWaTer/metacatalog

- Contributions very welcome

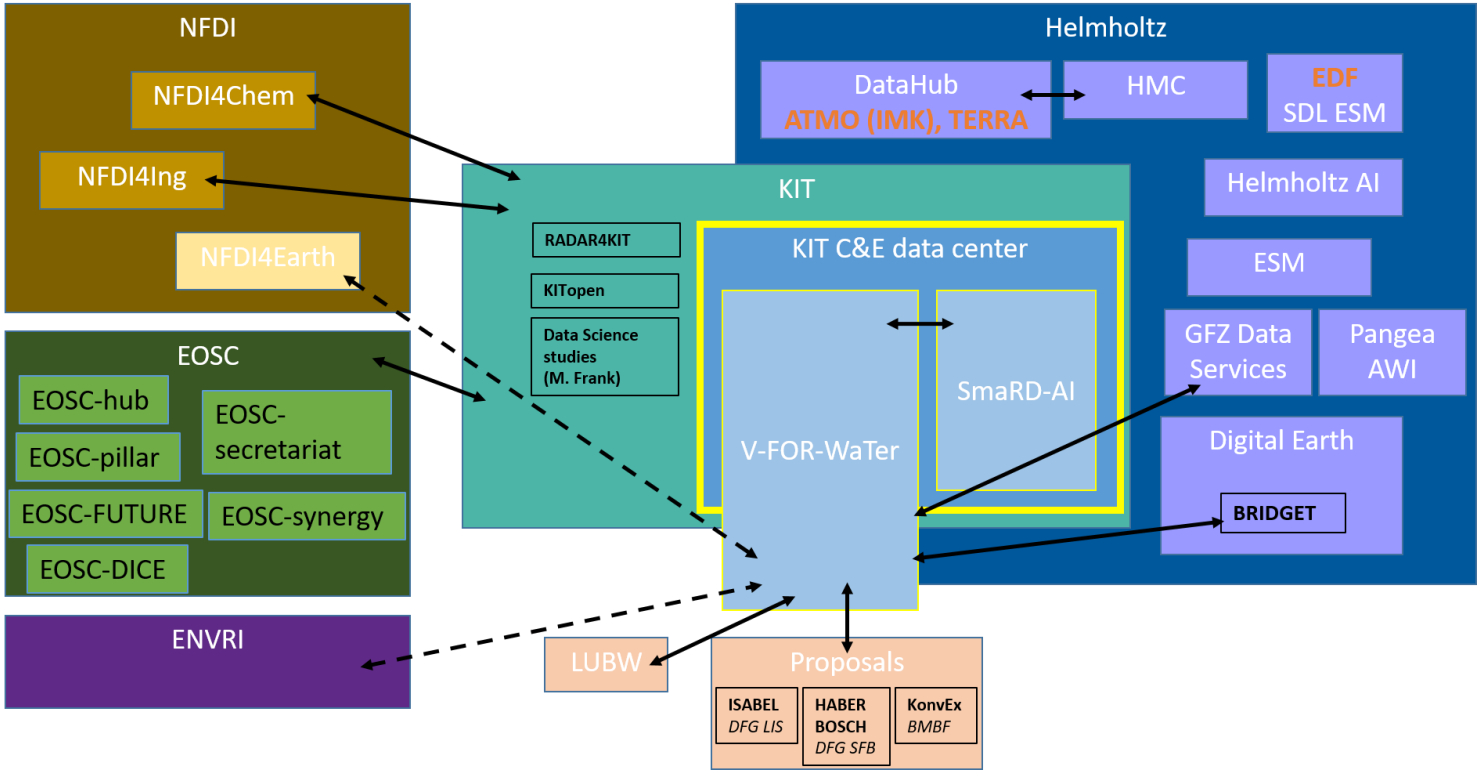
Where do we stand?

- Already implemented:
  - Extensive metadata model to ensure usability of stored datasets
  - Extensible database for user data
  - Prototype of portal
    - Quick filter to show available options interactively and advanced for more complex queries
    - Data preview and download functionality
    - Access restrictions to secure download and use of datasets with an embargo
    - First usable tools

Where do we stand?

- To do…
  - Implement last steps for upload, more tools, uncertainty information
  - Finalise drag&drop workflow builder to combine tools
  - Finalise connection to GFZ repository (Kirsten Elger, Damian Ulbricht)
- Sustainability
  - Project proposals
  - KIT Climate and Environment Centre
  - NFDI

V-FOR-WaTer and other initiatives



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Questions?

www.vforwater.de